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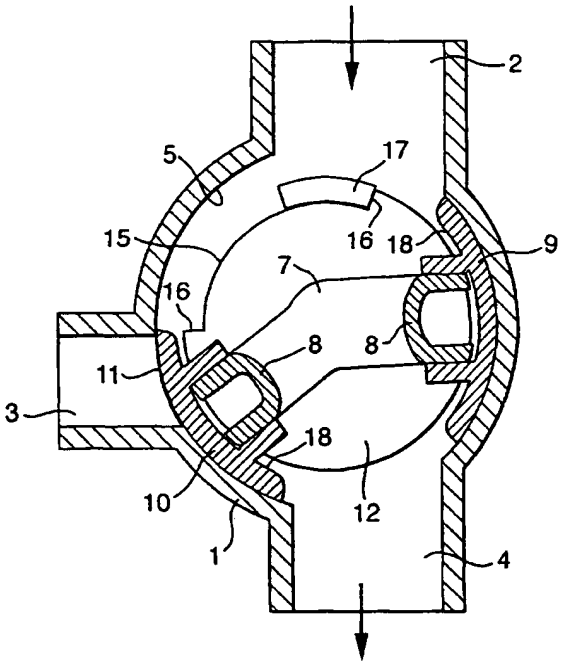
(54) Title: WATER SHUT-OFF DEVICE FOR CONTROLLING A HEATING SYSTEM FOR A MOTOR VEHICLE



(57) Abstract: The invention relates to a valve or water shut-off device for controlling a heating system for a motor vehicle. Sliders of limited volume and area are provided therein for sealing off different channels, which sliders sit on a central support element (8). By this means, when plastics are used as the material for the housing (1) and sliders (9; 10), it is possible to achieve lower frictional forces.

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Water shut-off device for controlling a heating system for a motor vehicle

The present invention relates to vehicle technology and, in particular, the heating system for a motor vehicle, wherein liquid (for example water) circulation is controlled by means of, *inter alia*, a valve or a water shut-off device.

In this area of technology, valves or shut-off devices have been constructed in the form of a shut-off cock wherein both the plug of the cock and also the shut-off housing are made of elastomer. Relatively large sliding surfaces present therein result in a high degree of friction, leading to difficulty in movement and to not inconsiderable wear, inter *alia* because granular particles in the flowing liquid enter the region of the sliding seal. Using Teflon in this context, however, results in the shut-off device becoming considerably more expensive.

The present invention seeks to provide a valve or a water shut-off device, for controlling a heating system for a motor vehicle, that can be manufactured cheaply, ensures good sealing and, at the same time, involves low frictional forces.

According to a first aspect of the present invention there is provided a valve for controlling flow of liquid in a heating system for a motor vehicle, the valve comprising

a housing having an inlet and an outlet and

a flow control member including at least one sealing member movable relative to the control member, wherein the control member is mounted for movement between an open position in which the inlet and outlet are in fluid communication with each other and a closing position in which said at least one sealing member is able

substantially to prevent fluid communication between the inlet and outlet. The sealing member, being able to move relative to the control member enables the valve to be configured such that there is relatively little frictional resistance when moving the control member between the open position and the closing position, yet provide good sealing action when the control member is in the closing position. Because there may be less friction between the contact surfaces of the valve, compared to a conventional shut-off cock, the valve according to the present invention, may be less susceptible to wear in use.

The valve is advantageously arranged such that, in use, the sealing member is able substantially to prevent fluid communication between the inlet and outlet by virtue of a sealing effect caused by the sealing member being urged, primarily as a result of the pressure of the liquid flowing through the valve, into a sealing position. The urging of the sealing member into a sealing position is advantageously substantially entirely as a result of the pressure of the liquid flowing through the valve. Thus, there is no need for springs to be provided to assist the sealing action. Providing such springs (i) would increase the complexity of the valve and might therefore increase manufacturing costs, and (ii) might have the disadvantage of increasing frictional forces when moving the flow control member between the open and closing positions. Preferably, no resilient members are provided for the purpose of urging a sealing member towards a position in which it seals an outlet of the valve.

Preferably, the flow control member is rotatably mounted.

The flow control member may include an arm, on which the sealing member is mounted. The sealing member is preferably slidably mounted on the arm. Preferably, the flow control member is rotatably mounted and at the end of the arm there is provided a rib-shaped element running parallel to the axis of rotation of the flow control member and the sealing member is preferably slidably mounted on the rib-shaped element. The sealing members are preferably slidably mounted for movement in a radial direction.

A sealing member is advantageously movable such that, when the control member is in the closing position the sealing member is movable to and from a position in which fluid communication between the inlet and outlet is substantially prevented.

Preferably a sealing member is able, in use, to engage a surface defining the inlet. Alternatively or additionally, a sealing member may be able, in use, to engage a surface defining the outlet. Alternatively, a sealing member may be able to engage some other surface in such a way that substantially prevents fluid communication between the inlet and the outlet.

In the case where the flow control member is rotatably mounted, the surface defining the outlet or inlet is conveniently curved and the corresponding surface of the or each sealing member is also preferably curved, preferably with a curvature suitable for providing a good sealing action.

The housing may be substantially cylindrical in cross-section.

The or each sealing member is conveniently mounted inside the housing and the sealing member is preferably movable towards and away from the exterior of the housing.

For example, where the housing is substantially cylindrical and the control member is mounted for rotation about an axis coincident with the axis of the housing, the or each support member may be radially movable towards and away from the inlet/outlet.

The housing is preferably made of a plastics material. The other components, for example the sealing members, are also preferably made of a plastics material.

Advantageously the housing further comprises a second outlet, wherein the control member and said at least one sealing member is so arranged that the control member is movable between a position in which the inlet and the second outlet are in fluid communication and a position in which fluid communication between the inlet and the second outlet is substantially prevented. The second outlet may, in use, serve as an outlet to a bypass channel.

Preferably there are two sealing members. There may, of course, be more than two sealing members. Each sealing member is preferably associated with a respective inlet or outlet of the valve.

If the housing has a second outlet, preferably, a first sealing member is associated with the outlet and a second sealing member is associated with the second outlet. For example, the valve may be so arranged that a) with the flow control member in the open position, the first sealing member allows maximum fluid communication between the inlet and the outlet and the second sealing member substantially closes the second outlet and b) with the flow control member in the closing position, the first sealing member substantially closes the outlet and the second sealing member allows maximum fluid communication between the inlet and the second outlet. Advantageously, the sealing

members are so arranged that during movement of the flow control member from the open position to the closing position, the cross-sectional area of the portion of the outlet closed by the first sealing member increases as the cross-sectional area of the portion of the second outlet closed by the second sealing member decreases.

According to a second aspect of the present invention, there is provided a water shut-off device for controlling a heating system for a motor vehicle, having a housing made of plastics, which has at least one inlet channel and at least one outlet channel, and having a rotation member mounted in the housing, by means of which rotation member the channels are arranged to be brought into a state of flow communication with one another as desired, which rotation member has at least one support element, which extends away from an axis of rotation in a radial direction and on which a slider made of plastics sits, by means of which a channel can be opened and closed, for which purpose the rotation member is rotatable, and wherein the slider has a curved closing surface, which, at least in part, bears slidably against a circular-cylindrical boundary surface of the opening orifice of the relevant channel. In comparison to the cylindrical cock plug previously used, having a support element and one or more individual sliders considerably reduces sliding surface contact between the slider and the housing of the shut-off device. As a result, whilst there is good sealing action, less friction occurs in the contact between the plastics, which leads to few manifestations of wear and to improved movement.

The sliders are preferably capable of movement in a radial direction on the support elements so that automatic compensation for the purpose of sealing contact occurs.

Preferably the support elements are, in each case, rib-shaped elements running in an axial direction. Advantageously the sliders, in each case, have pressure surfaces facing inwards in a radial direction and arranged to be acted upon by water pressure, which runs substantially parallel to the closing surface. Sealing is increased when the pressure surfaces (that is to say the surfaces facing inwards in a radial direction and acted upon by water pressure) on the sliders run substantially parallel to the closing surface.

The present invention further relates to the use of a valve according to the first aspect of the invention or a water shut-off device according to the second aspect of the invention, such use being in a heating system for a motor vehicle. In use, the inlet, or inlet channel, is advantageously connected to a hot liquid (for example water) outlet pipe and the outlet, or outlet channel, is advantageously connected to a heat exchanger for supplying hot air in the motor vehicle. For example, during operation of the motor vehicle, liquid, for example water, passes from the engine via the inlet (or inlet channel) to the valve whereupon the liquid may pass to the heat exchanger, depending on the state of the valve. For example, if hot air is required in the motor vehicle, the flow control member of the valve, or the rotation member of the water shut-off device, as the case may be, is moved to the position in which the liquid may pass through the valve from the inlet to the outlet; the liquid then flows from there to the heat exchanger.

Where the heating system of the motor vehicle includes a bypass outlet pipe bypassing the heat exchanger, use may be made of a valve according to the first aspect of the

invention, the valve including a second bypass outlet. In use, the inlet of the valve is connected to a hot liquid outlet pipe, the outlet of the valve is connected to a heat exchanger and the second outlet of the valve is connected to a bypass outlet pipe. The valve may then be operated to direct liquid to the heat exchanger, to direct liquid to the bypass outlet pipe so that the liquid bypasses the heat exchanger or to direct liquid to both the heat exchanger and the bypass outlet pipe. The valve is advantageously so arranged that the ratio of the rates of flow of the liquid flowing to the heat exchanger and the bypass outlet pipe, respectively, is variable, the ratio depending on the position of the flow control member.

The invention is illustrated below with reference to the exemplary embodiments shown in purely diagrammatic form in the drawings, in which:

Fig. 1 is a longitudinal section through a water shut-off device;

Fig. 2a is a cross-section through the shut-off device according to Fig. 1 in an operating position;

Fig. 2b is a cross-section corresponding to Fig. 2a, but in a different operating position;

Fig. 3a is a cross-section through another arrangement of a shut-off device in the completely opened state; and

Fig. 3b is a cross-section corresponding to Fig. 3a, but in the completely closed state.

Fig. 1 shows a shut-off device, which has a housing 1. In accordance with Fig. 2a and 2b, the said housing 1 has an inlet channel 2, a bypass channel 3 and an outlet channel 4 to the heat exchanger. Between the channels there are sliding surfaces 5 in the shape of a circular cylinder.

Inside the housing there is a support element 7, which is rotatable about an axis 6. The support element 7 has rib-shaped elements 8, which run parallel to the axis 6 of rotation and, in a radial direction, extend away from the axis 6 of rotation, as can clearly be seen from Fig. 2a and 2b. On each of those rib-shaped elements 8, a slider 9, 10 is mounted so as to be capable of movement in a radial direction. The said slider has a sliding surface 11 (closing surface) in the shape of part of a circular cylinder, which slides against the corresponding inner surface 5 of the housing 1.

Inside the housing and in the region of the rib-shaped elements, there is a hollow space 12, by way of which a flow can be selected between the inlet 2 and the bypass channel 3 or the outlet channel 4, as desired, it being possible for the relevant slider to control the amount of flow if the channel cross-section is only partially opened, as desired.

The support element 8, which can be rotated by means of a lever 13, has a part 14, in which two stops 16 are formed by a recess 15 in the shape of a segment of a circle, which stops 16 co-operate with a housing stop piece 17. The said stops define two operating positions, which are shown in Fig. 1, 2a and 2b. In the operating position according to Fig. 2a, the slider 10 closes the bypass channel 3. At the same time, the outlet channel 4 is kept

open so that the inlet channel 2 and the outlet channel 4 are in a state of flow communication (see arrows in Fig. 2a). In the operating position according to Fig. 2b, the slider 9 closes the outlet channel 4, so that the inlet channel 2 and the bypass channel 3 are in a state of flow communication (see arrows in Fig. 2b). The invention is, of course, not limited to a configuration of that kind, especially regarding the number of channels and the number of sliders.

The housing 1 and also the sliders 9, 10 are made preferably of plastics and, in this case, preferably of polyamides. The polyamides can be PPA, TA66 or PPS.

The sliders 9 and 10 have pressure surfaces 18 facing inwards and arranged to be acted upon by water pressure, which pressure surfaces 18 are substantially parallel to the closing surface 11. Because the sliders 9, 10 are arranged to be moveable in a radial direction on the support elements 8, the water pressure prevailing inside the housing can press the sliders outwards in a radial direction against the cylindrical inner surfaces 5 of the housing and, as a result, increase the sealing action.

Fig. 3a and 3b show an arrangement having only one slider 9. In this case, the bypass channel has been omitted for cases where bypass operation is not necessary. In other respects, the arrangement corresponds to the exemplary embodiment according to Fig. 2a and 2b.

In the operating position according to Fig. 3a, the slider 9 is in such a position that the inlet channel 2 and outlet channel 4 are in a state of flow communication (see arrows in Fig. 3a). In the position according to Fig. 3b, the slider 9 closes the outlet channel thereby preventing

flow communication between the inlet channel 2 and the outlet channel 4.

Claims

1. Valve for controlling flow of liquid in a heating system for a motor vehicle, the valve comprising

a housing having an inlet and an outlet and

a flow control member including at least one sealing member movable relative to the control member, wherein the control member is mounted for movement between an open position in which the inlet and outlet are in fluid communication with each other and a closing position in which said at least one sealing member is able substantially to prevent fluid communication between the inlet and outlet.

2. Valve according to claim 1, wherein the valve is arranged such that, in use, the sealing member is able substantially to prevent fluid communication between the inlet and outlet by virtue of a sealing effect caused by the sealing member being urged, primarily as a result of the pressure of the liquid flowing through the valve, into a sealing position.

3. Valve according to claim 1 or 2, wherein the flow control member is rotatably mounted.

4. Valve according to any preceding claim, wherein the flow control member includes an arm, on which the sealing member is mounted.

5. Valve according to claim 4, wherein the sealing member is slideably mounted on the arm.

6. Valve according to any preceding claim, wherein a sealing member is movable such that, when the control member is in the closing position the sealing member is moveable to and from a position in which fluid

communication between the inlet and outlet is substantially prevented.

7. A valve according to any preceding claim, wherein the or each sealing member is able, in use, to engage a surface defining the inlet.

8. A valve according to any preceding claim, wherein the or each sealing member is able, in use, to engage a surface defining the outlet.

9. A valve according to claim 7 or claim 8, when dependent on claim 3, wherein the surface defining the outlet or inlet is curved and the corresponding surface of the or each sealing member is curved.

10. A valve according to any preceding claim, wherein the housing is substantially cylindrical in cross-section.

11. Valve according to any preceding claim, wherein the sealing member is mounted inside the housing and is movable towards and away from the exterior of the housing.

12. A valve according to any preceding claim, wherein the housing is made of a plastics material.

13. A valve according to any preceding claim, wherein the housing comprises a second outlet, and wherein the control member and said at least one sealing member is so arranged that the control member is movable between a position in which the inlet and the second outlet are in fluid communication and a position in which fluid communication between the inlet and the second outlet is substantially prevented.

14. Valve according to any preceding claim, wherein there are two sealing members.

15. Valve according to claim 14, wherein each sealing member is associated with a respective inlet or outlet of the valve.

16. Valve according to claim 15, when dependent on claim 13, wherein a first sealing member is associated with the outlet and a second sealing member is associated with the second outlet.

17. Water shut-off device for controlling a heating system for a motor vehicle, having a housing made of plastics, which has at least one inlet channel and at least one outlet channel, and having a rotation member mounted in the housing, by means of which rotation member the channels are arranged to be brought into a state of flow communication with one another as desired, which rotation member has at least one support element, which extends away from an axis of rotation in a radial direction and on which a slider made of plastics sits, by means of which a channel can be opened and closed, for which purpose the rotation member is rotatable, and wherein the slider has a curved closing surface, which, at least in part, bears slidably against a circular-cylindrical boundary surface of the opening orifice of the relevant channel.

18. Water shut-off device according to claim 17, characterised in that the sliders are, in each case, arranged to be displaceable in a radial direction on the support elements.

19. Water shut-off device according to claim 17 or 18, characterised in that the support elements are, in each case, rib-shaped elements running in an axial direction.

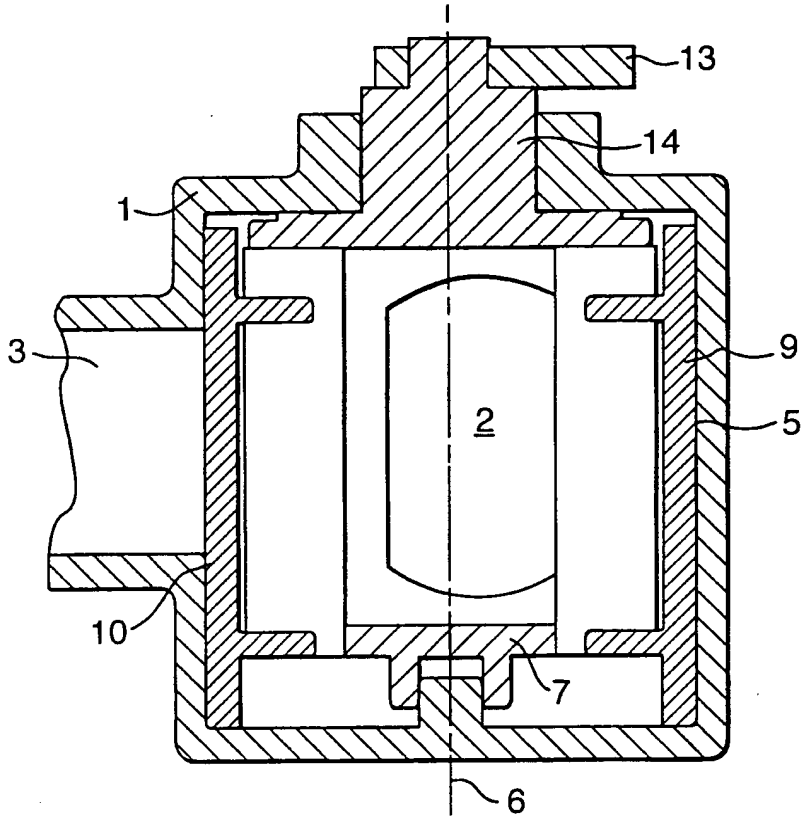
20. Water shut-off device according to any one of claims 17 to 19, characterised in that the sliders, in each case, have pressure surfaces facing inwards in a radial direction and arranged to be acted upon by water pressure, which run substantially parallel to the closing surface.

21. Use of a valve according to any of claims 1 to 16 or a water shut-off device according to any of claims 17 to 20 in a heating system for a motor vehicle.

22. Use according to claim 21, wherein the inlet, or inlet channel, is connected to a hot liquid outlet pipe and the outlet, or outlet channel, is connected to a heat exchanger for supplying hot air in the motor vehicle.

23. Use of a valve according to claim 13 or any of claims 14 to 16, when dependent on claim 13, wherein the inlet is connected to a hot liquid outlet pipe and the outlet is connected to a heat exchanger for supplying hot air in the motor vehicle and the second outlet is connected to a bypass outlet bypassing the heat exchanger.

Fig.1.



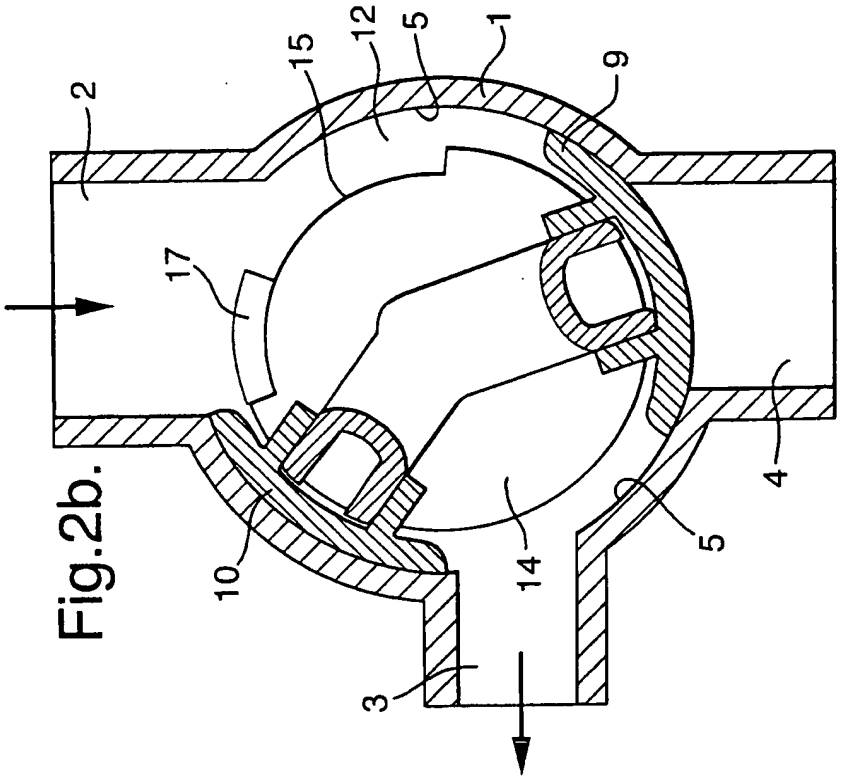


Fig.2b.

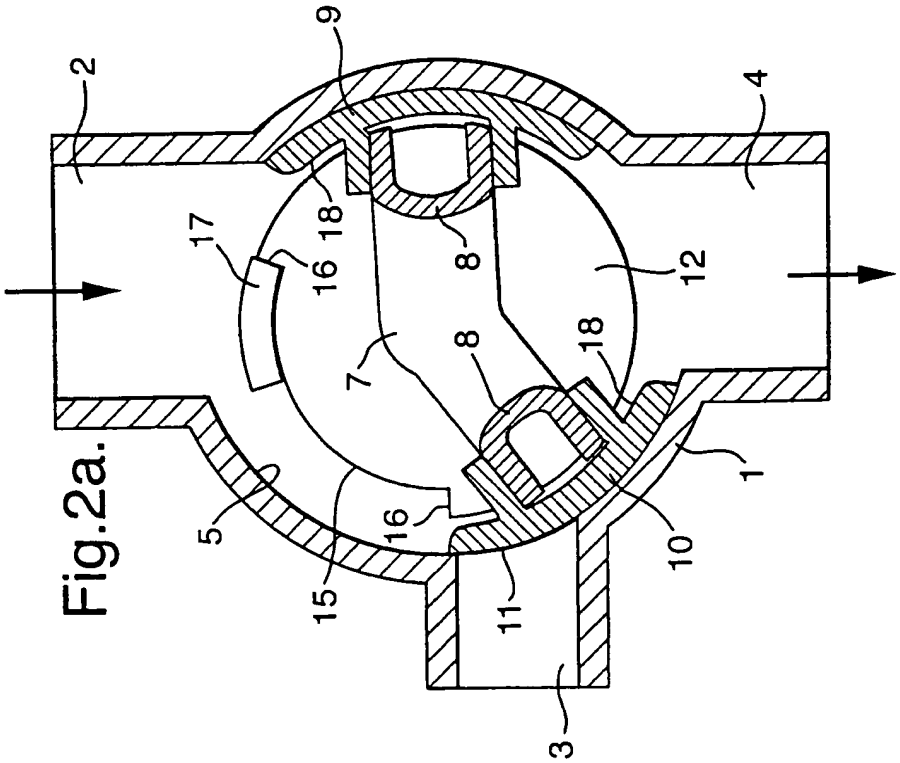


Fig.2a.

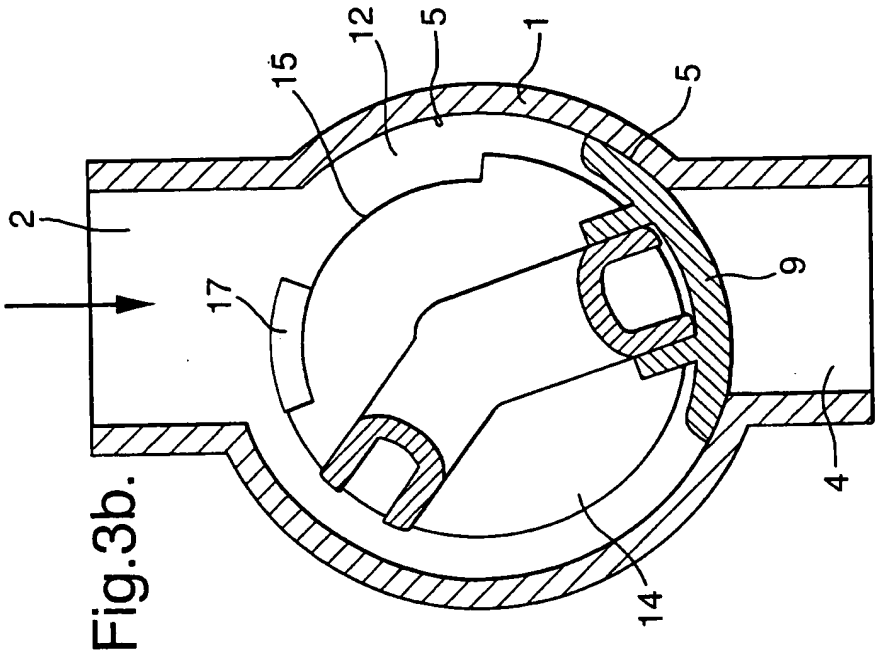


Fig.3b.

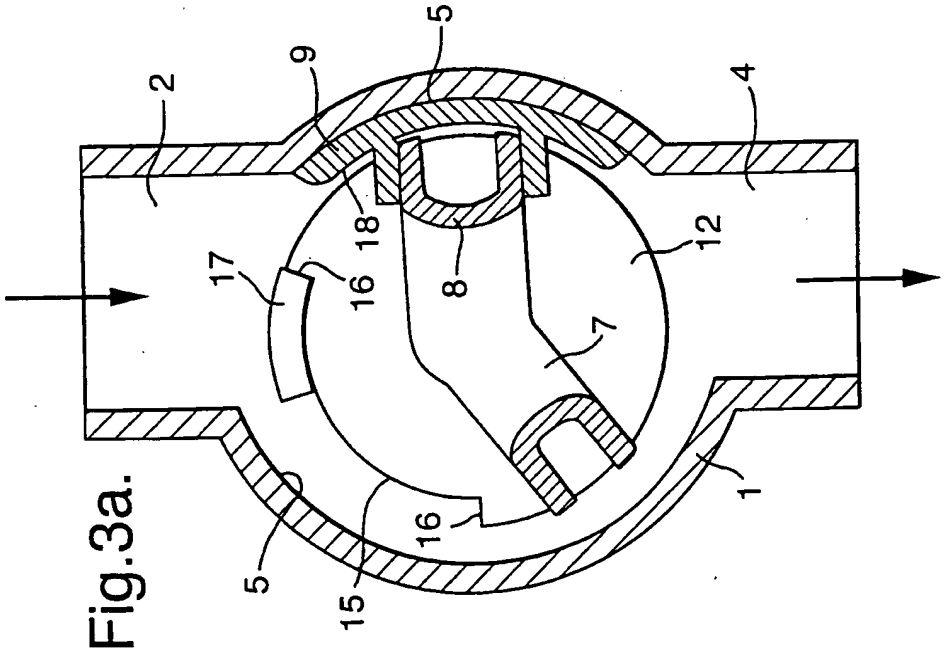


Fig.3a.

INTERNATIONAL SEARCH REPORT

Internat Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F16K5/18 F16K11/085 F16K27/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F16K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 602 961 A (ALEXANDRE MAES) 6 April 1926 (1926-04-06) figures 1-5 page 1, line 1 - line 5 page 1, line 15 - line 17	1-12, 17-22
X	FR 2 142 186 A (PEUGEOT & RENAULT) 26 January 1973 (1973-01-26) figures 1-5 page 1, line 2 - line 4 page 3, line 3 - line 5	1-6, 8-13, 17-23
Y		7,14-16
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
11 January 2001	18/01/2001

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

Internat Application No
PCT/EP 00/08493

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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